

EECS2101-Z Winter 2026
Fundamentals of Data Structures
Example Exam Questions
Final Exam
April 23, 2026
Time Limit: 180 Minutes

Name (Last, First): _____

Student Number: _____

PPY Login _____

Signature _____

• **NO QUESTIONS DURING THE EXAM.**

- This is a 180 minute test.
- This is a closed book test:
 - ~~A one-sided data sheet is permitted.~~
 - No calculator is permitted.
- Spell **clearly** your name, student number, and other required information.
- For the written questions:
 - Write your answers with either a pen or a pencil. Writing in a colour **other than black and blue** (e.g., red, green, purple) will receive an **immediate zero**.
 - Writing in **cursive** will receive an **immediate zero**.
 - Write legibly: unrecognized answers will receive **no** credits.
 - Express your ideas concisely and precisely.
 - Organize your answers.
- Some tips for tackling the exam questions:
 - Spend a few minutes skimming over the entire question booklet to have an idea about what topics are covered.
 - Build the confidence and momentum by first answering questions that you feel more comfortable about.
 - Do not get stuck in a single question for too long: set yourself some time limit, document where you get stuck, and come back later.
 - It is natural to feel nervous and frustrated when you do not have the immediate clues about the more challenging questions. Just **expect** and **embrace** those feelings.
 - Stay calm and identify/highlight key terms in questions.

Do not write in this table which contains your raw mark scores.

Problem	Points	Score
1	20	
2	30	
3	50	
Total:	100	

1. Consider the following fragment of Java code:

```
1 boolean containsDuplicate (int[] a, int n) {  
2     for (int i = 0; i < n; ) {  
3         for (int j = 0; j < n; ) {  
4             if (i != j && a[i] == a[j]) {  
5                 return true; }  
6             j ++; }  
7         i ++; }  
8     return false; }
```

Derive, in the worst case, the number of primitive operations executed to return the result.

2. (a) Given a BST rooted at node n , describe how an entry (k, v) can be inserted.

Requirements. Do not write any Java code. Describe the steps precisely and concisely.

[of 20 marks]

- (b) Explain why an *inorder* traversal of a binary search tree produces a sequence of entries whose keys are sorted in an *increasing* order.

[of 10 marks]

3. (a) Consider the following classes of functions:

- $O(n)$
- $O(\log(n))$
- $O(n^2)$
- $O(1)$
- $O(2^n)$
- $O(n^3)$
- $O(n \cdot \log(n))$

Say each of the above functions maps from input size n to the *approximated* algorithm running time. Sort, from left to right, the above classes of functions from the cheapest to the most expensive.

Caution: You will lose **all** marks if the order is not completely correct.

[of 10 marks]

For Part (b) to Part (d), consider the following statements:

- (A) $3n + 7$ is $O(n \cdot \log(n))$
- (B) $3n + 7$ is $O(n)$
- (C) $3n + 7$ is $O(1)$
- (D) $3n + 7$ is $O(2^n)$
- (E) $3n + 7$ is $O(\log(n))$
- (F) $3n + 7$ is $O(n^2)$

(b) Which of the above statement or statements are *correct*? Do not guess: you lose **all** marks if you make a mistake.

[of 10 marks]

(c) Among the above statement or statements that are *correct*, which **one** is the most *accurate*?

[of 10 marks]

(d) Justify your answer to the previous question. That is, clearly explain why it is more *accurate* than all other *correct* statements.

[of 10 marks]

(e) Prove that $f(n) = 4n^3 - 5n^2 + 59 + n^4 + 9n$ is $O(n^4)$.

[of 10 marks]

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Do **not** detach other question pages from the exam booklet.

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